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Third edition
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Alpine ski-boots — Safety requirements and test methods

Chaussures de ski pour skis alpins — Exigences de sécurité et méthodes d'essai

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Contents

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

International Standard ISO 5355 was prepared by Technical Committee ISO/TC 83, *Sports and recreational equipment*, Subcommittee SC 3, *Ski bindings*.

This third edition cancels and replaces the second edition (ISO 5355:1991), which has been technically revised.

Annexes A, B, C and D form an integral part of this International Standard. Annex E is for information only.

Alpine ski-boots – Safety requirements and test methods

1 Scope

This International Standard specifies the safety requirements, test methods and marking of ski-boots which are used with current systems of alpine ski-bindings with attachment at the boot toe and boot heel, the proper release function of which depends on the dimensions and design of the interfaces.

For ski-binding systems that function irrespective of the sole shape or that have different requirements for the sole dimensions, it is not always necessary for the ski-boot soles to comply with this International Standard in order to achieve the desired degree of safety.

This International Standard is applicable to ski-boots of sizes 15,0 and larger (types A and C) in the Mondopoint system (see annex A).

2 Normative references

The following standards contain provisions which, through reference in this text, constitute provisions of this International Standard. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this International Standard are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below. Members of IEC and ISO maintain registers of currently valid International Standards.

ISO 527-1:1993, *Plastics – Determination of tensile properties – Part 1: General principles.*

ISO 554:1976, *Standard atmospheres for conditioning and/or testing – Specifications.*

ISO 1183:1987, *Plastics – Methods for determining the density and relative density of non-cellular plastics.*

ISO 2039-1:1987, *Plastics – Determination of hardness – Part 1: Ball indentation method.*

ISO 9407:1991, *Shoe sizes – Mondopoint system of sizing and marking.*

3 Definitions

For the purposes of this International Standard, the following definitions apply.

3.1 interface: That part of the ski-boot intended for contact with the ski-binding.

3.2 front interface: That part of the ski-boot intended to fit with the front binding.

3.3 free space: Space intended to avoid contact between ski-boot and binding, especially during step in/step out or release.

3.4 median plane: Middle plane of the sole, longitudinal and perpendicular to the bearing surface.

3.5 bearing surfaces: Front and rear surfaces of the boot sole which are in contact with a plane on which the boot is standing.

3.6 ski brake: Device to stop the ski after release of the binding.

4 Safety requirements

4.1 Dimensions

Only the dimensions given in this International Standard shall be respected. Other boot dimensions need not correspond to those given in the figures.

Fundamentally, all dimensions shall be within the indicated tolerances. However, relevance to safety varies in importance depending on the indicated dimensions.

Looking at several dimensions ("dimensions of the 2nd degree"; see annex E), a deviation from the tolerances can be accepted, provided that the following requirements are respected.

a) The deviations shall remain exceptional.

b) The deviations shall be small.

c) No limitations of function shall arise with all marketable and critical bindings.

d) The tolerances shall be respected at the next possible chance (e.g. reconstruction of a tool).

4.2 Design

4.2.1 Sole length

The sole lengths of the two ski-boots in a pair shall not differ by more than 2 mm.

4.2.2 Symmetry

The sole dimensions in the toe and heel interface areas shall be symmetrical about the median plane within an admissible deviation of 1 mm.

4.2.3 Side walls at boot toe

The side walls of the sole at the boot toe, up to a distance of at least 25 mm from the toe end, shall be perpendicular to the bearing surface within an admissible inward–outward deviation of 1 mm.

If the side walls of the sole are built in two parts, it shall be ensured that no part of the lower area of the sole protrudes beyond the upper profile.

4.2.4 Side walls at boot heel

The lateral side walls of the sole at the boot heel, up to a distance of at least 70 mm for type A and 50 mm for type C from the heel end, shall be perpendicular to the bearing surface, or tapered inwards–outwards between 0° and 10° up to a height of 14 mm.

Between 70 mm and 85 mm for type A and 50 mm and 65 mm for type C, up to a height of 14 mm, no part of the sole shall project beyond the 10° side wall limitation.

If lateral grooves of more than 2 mm depth are present at the heel, supports at least complying with figure 7 shall remain.

4.2.5 Free spaces

4.2.5.1 The boot shell in the front of the boot along the arcs with radius of 41,5 mm±3,5 mm for type A and 35 mm±3 mm for type C shall lie outside the free space 1 (see figure 3).

4.2.5.2 Within the free space 2 (see figure 3), the arcs with radius of 41,5 mm±3,5 mm for type A and 35 mm±3 mm for C (see figures 1 and 2, section A-A) shall be continued as an arc without discontinuity, providing a smooth transition to the sides of the shaft, between 25 mm and 50 mm for type A, and between 25 mm and 44 mm for type C. This condition is fulfilled when the curvature of the shell within the free space 2 remains convex (no flex point) in both longitudinal and vertical planes.

Symmetry is not required.

4.2.5.3 The boot shell at the rear of the boot along the arcs with radius of 37 mm±4 mm for type A and 27 mm±3 mm for type C shall lie outside the free spaces 3 and 4 (see figure 4) available for the ski-binding and for handling the boot and binding.

4.2.6 Interfaces

4.2.6.1 At the front interface (see figure 5):[1)]

a) no material in the sole shall protrude perpendicular to the vertical surfaces;

b) the coefficient of dynamic friction between the boot material and a low-friction element of polytetrafluoroethylene (PTFE) shall be $\leqslant 0{,}1$;

c) the profile of the shell in the 82° to 90° space can be straight or convex in any vertical plane providing the profile stays within the 82° to 90° limit.

4.2.6.2 On both sides of the boot soles, an interface for the pushing rod test of the adjustment device, as shown in figure 5, shall be available.

This area shall be parallel to the median plane and shall lie at the same height on both sides of the sole.

NOTE — Bindings for which the release-adjustment test can be carried out by applying a lateral force on the surface should be conceived so as not to interfere with the application of this force. This test method is only one among many.

4.2.7 Bevelled areas

A tread pattern is permitted in the front area and the rear bevelled area.

1) The area of figure 5 below h can be safety related and therefore is still subject to future investigation by ISO/TC 83/SC 3/WG 3. The overall intent is to avoid interference between the boot and binding outside the "low-friction" area. New designs of bindings and boots should be developed so as to avoid this type of interference.

4.2.8 Bearing surface at heel

The bearing surface at the heel shall satisfy the following requirements.

a) It shall be suitable for closing the heel part and shall allow longitudinal elastic travel of the binding.

b) It shall provide a correct fit on the bearing plate of the binding.

c) There shall be no hindrance to sideways movement of the sole if the binding releases.

d) There shall be no interference with proper functioning of ski brakes.

For evaluation of a) to d), the following tests shall be carried out.

e) All boots shall fulfil a penetration test in accordance with B.1 (see annex B).

f) If a material other than TPU (thermoplastic polyurethane) is used in the heel part of the boot, there shall be at least one longitudinal low friction area to act as a bearing surface for the ski brake as shown in figure B.2. These boots shall undergo the test according to figure B.3 and fulfil the requirements of 5.3.1.1.

Horseshoe-shaped bearing surfaces shall comply with figures 8 and 9.

Testing of the evenness of the bearing surfaces given in figures 1 and 2 shall be carried out in accordance with annex D.

4.2.9 Low-friction zone

4.2.9.1 The coefficient of dynamic friction between the low-friction zone of the boot and a low-friction element of polytetrafluoroethylene (PTFE) shall have a maximum value of 0,10 rounded off to two decimal places.

4.2.9.2 No material that would interfere with side-to-side movement of the boot shall protrude below the low-friction zone.

4.2.10 Style of boot shell

In figures 1 and 2, sections A-A and B-B, any style of boot shell (exterior surface) is admissible, provided

– it is symmetrical to the median plane;

– in section A-A, the curvature at any point up to a distance of 25 mm min. stays within the limits of 41,5 mm±3,5 mm for type A and 35 mm±3 mm for type C;

– in section B-B, the curvature at any point up to a distance of 26 mm min. for type A and 25 mm min. for type C, stays within the limits of 37 mm±4 mm for type A and 27 mm±3 mm for type C.

4.2.11 Mounting point

The mounting point for positioning the binding on the ski shall be indicated by a line on each side of the lower surface of the boot as close as possible to the ski. This line shall be clearly visible and permanent. It shall not be less than 10 mm in length and shall not be more than 5 mm for type A and 4 mm for type C from the middle of the boot sole length.

The deviation between left and right boot shall not be more than 1 mm.

5 Testing

If no specific test methods are indicated in 5.1 to 5.3, the characteristics of clause 4 shall be checked as appropriate, e.g. by measurement.

If not otherwise indicated, execute the testing under standard atmosphere 23/50 (see ISO 554) with ordinary tolerances.

5.1 Free space at boot toe and heel

Test the free space at the boot toe and heel with the test bodies as shown in annex D.

5.2 Bearing surface at heel

5.2.1 The requirement of 4.2.8 b) shall be tested as follows.

Move a test cylinder of 10 mm diameter and 20 mm length within the peripheral zone of 13 mm for type A and 10 mm for type C (see figures 8 and 9). The test shall not reveal a transverse variation in height greater than 1,5 mm in the longitudinal axis of the boot.

5.2.2 The requirement of 4.2.8 d) shall be tested as follows.

Move a test cylinder of 5 mm diameter and of length greater than the breadth of the sole along the longitudinal axis of the boot and later a test cylinder of 5 mm diameter and a length of 35 mm in the area between

25 mm and the value of dimension l_2 of figure 1 for type A, and

25 mm and the value of dimension l_2 of figure 2 for type C

from the heel end. Neither test shall reveal a variation in height greater than 1,5 mm along this axis.

5.3 Coefficient of friction

The coefficient of dynamic friction is determined by the ratio of the force F_1 necessary to move a low-friction element over the low-friction zone of the boot to the test load F_2 which is applied to the low-friction element.

5.3.1 Low-friction zone

5.3.1.1 Test equipment and conditions

The following test equipment and conditions will be required.

a) Six sample boots of at least three different sizes, stored for at least 14 days with the last 12 h of storage before test under the standard atmosphere.

b) Low-friction element 100 mm min. wide, 40 mm long, 1 mm min. thickness, and of peeled PTFE with the following characteristics:

1) density according to ISO 1183, method A, of 2,18 g/cm^3±3 %;
2) mean tensile stress, according to ISO 527-1 but with a specimen according to figure 10, equal to or over 28,8 N/mm^2;
3) mean percentage elongation according to ISO 527-1 but with a specimen according to figure 10, equal to or over 300;
4) mean ball-indentation hardness according to ISO 2039-1, method B, equal to or over 22,8 N/mm^2;
5) surface profile less than 6 µm.

NOTE — The low-friction element may be used for more than 30 measurements until marks of abrasion are visible.

c) Standard atmosphere: 23/50 according to ISO 554.

d) Test load F_1:

Type A = 500 N±5 N

Type C = 300 N±5 N

e) Measuring distance: 8 mm.

f) The relative speed of the boot to the low-friction element shall be 1 mm/s±0,2 mm/s.

5.3.1.2 Procedure

Submit the low-friction element to 10 preliminary measurements which are not taken into account for the evaluation.

Clean the low-friction zone of the sample boot using neutral soap and hot water, rubbing with a soft brush. Allow to dry. After cleaning, the low-friction zone shall be free of grease and soap.

Carry out five measurements, the first of which is ignored, on each sample boot. Deformation of the sole greater than 1 mm, which can be avoided by using an appropriate support (see figure 11) is not permitted.

The measurement error for the four significant measurements shall not exceed ±5 %.

Clean the low-friction element before measuring the next sample boot by rubbing with a clean soft cloth. After cleaning, the low-friction element shall be free of grease.

Determine the coefficient of dynamic friction by taking the mean value of the 24 measurements (6 boots × 4 measurements each).

5.3.2 Front interface area

If the material of the front interface is identical to the material of the low-friction zone, no testing is necessary.

If the materials are different, test as follows.

5.3.2.1 Test equipment and conditions

Inject a test specimen in the form of a plate (dimensions greater than or equal to the low-friction zone) or part of the sole with the low-friction zone of the diverging material.

5.3.2.2 Procedure

Test the coefficient of friction according to 5.3.1.2.

6 Marking

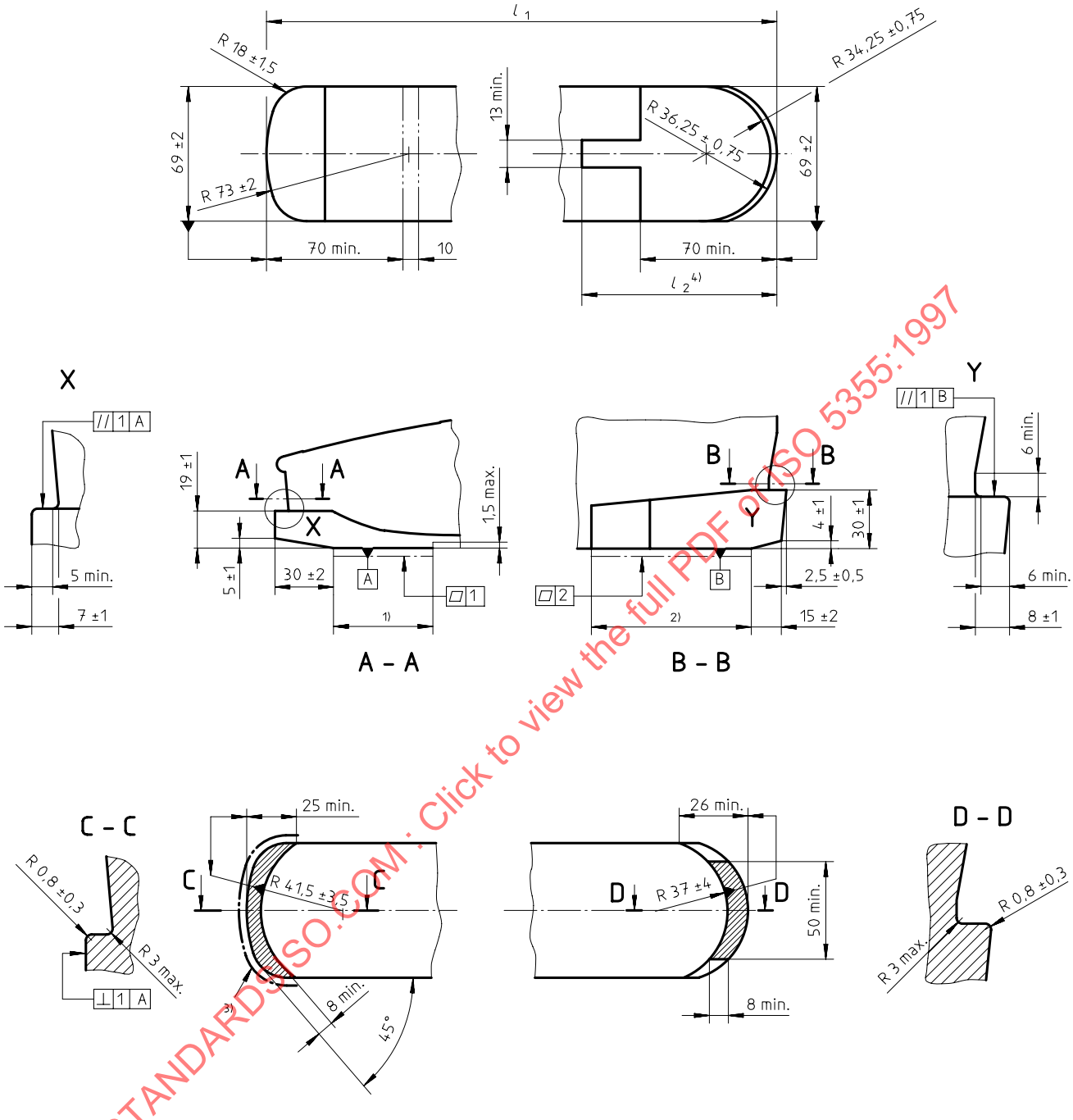
Ski-boots which meet the requirements of this International Standard shall be marked as follows:

a) reference to this International Standard;

b) name or trademark of the manufacturer or importer;

c) letter symbol A or C for type of boot beside the mounting point, at least 5 mm high. The letter shall be permanent and easily recognizable.

Dimensions in millimetres



l_1	< 300	⩾ 300
l_2	100 min.	120 min.

1) Low-friction zone/bearing surface

2) Bearing surface (see 3.5)

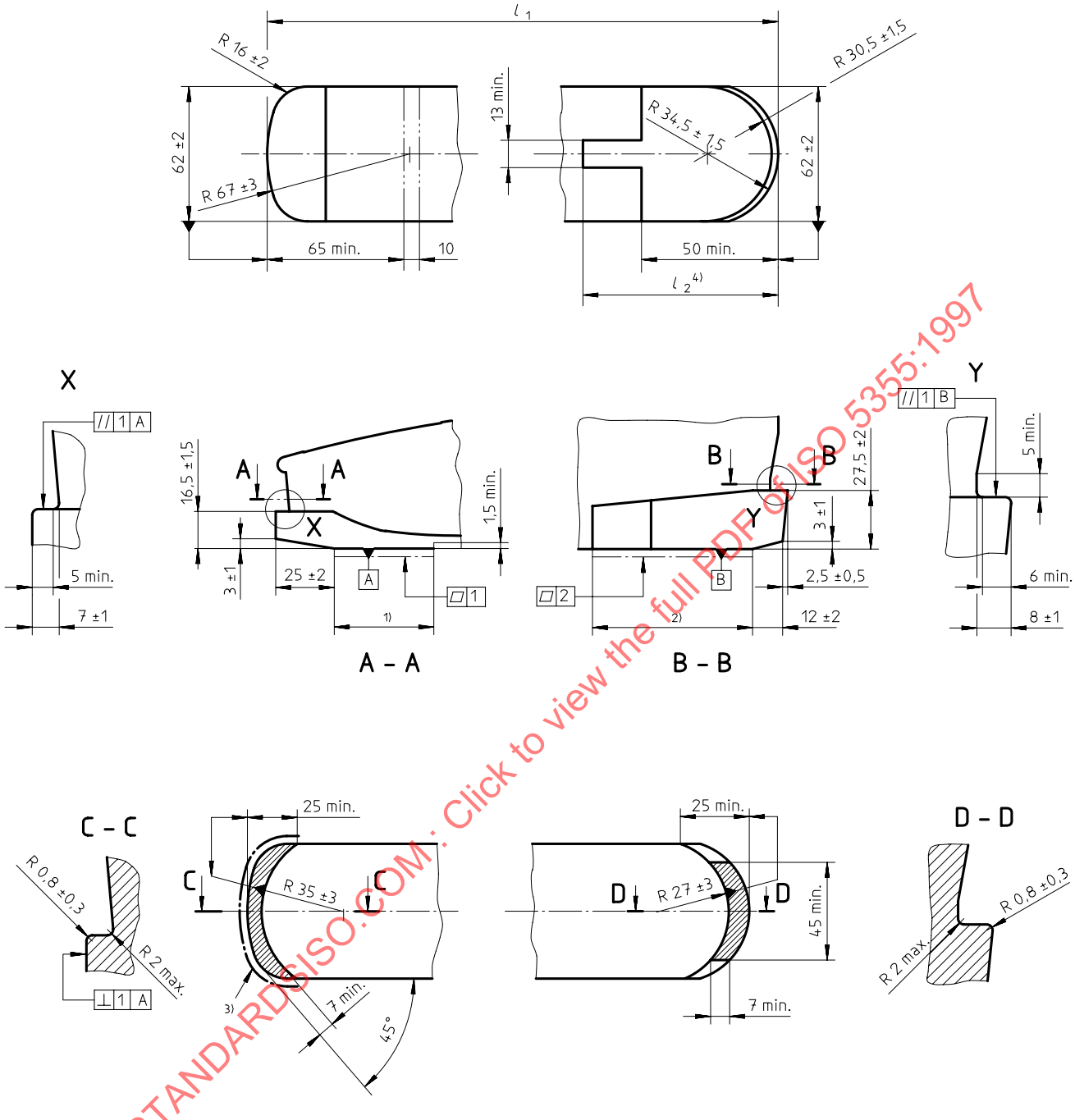
3) Area in which the tolerance of perpendicularity is valid (see 4.2.3)

4) For the dimension l_2, a transitional period until 1998-07-01 is provided

NOTE — Shaded areas are those in which the tolerances of evenness and the dimensions 19±1 and 30±1 are valid.

Figure 1 — Dimensions of boot toe and heel, type A

Dimensions in millimetres



l_1	< 240	⩾ 240
l_2	80 min.	90 min.

1) Low-friction zone/bearing surface

2) Bearing surface (see 3.5)

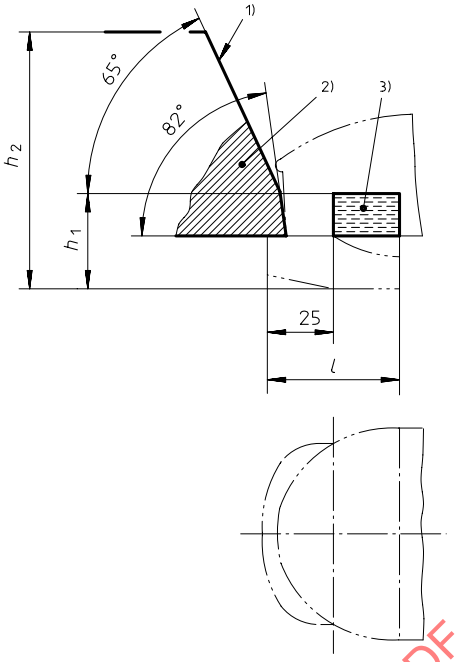
3) Area in which the tolerance of perpendicularity is valid (see 4.2.3)

4) For the dimension l_2, a transitional period until 1998-07-01 is provided

NOTE — Shaded areas are those in which the tolerances of evenness and the dimensions 16,5±1,5 and 27,5±2 are valid.

Figure 2 — Dimensions of boot toe and heel, type C

Dimensions in millimetres



Dimension	Type	
	A min.	C min.
h_1	33	29
h_2	100	80
l	50	44

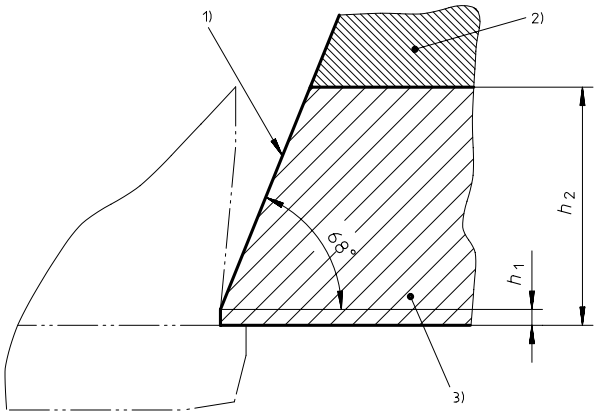
1) Cone

2) Free space 1 (4.2.5.1)

3) Free space 2 (4.2.5.2)

Figure 3 — Free spaces at boot toe

Dimensions in millimetres



Dimension	Type	
	A	C
h_1	6	5
h_2	105	90
width, symmetrical to the median plane	50	45

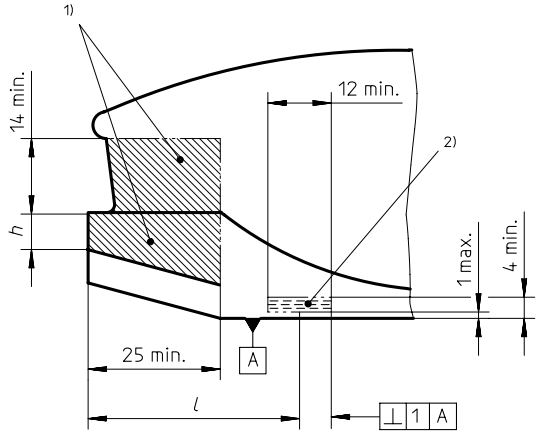
1) Cone

2) Free space 3 (see 4.2.5.3) Free space for handling boot and binding

3) Free space 4 (see 4.2.5.3) Free space for ski-binding

Figure 4 — Free space for ski-binding at boot heel

Dimensions in millimetres



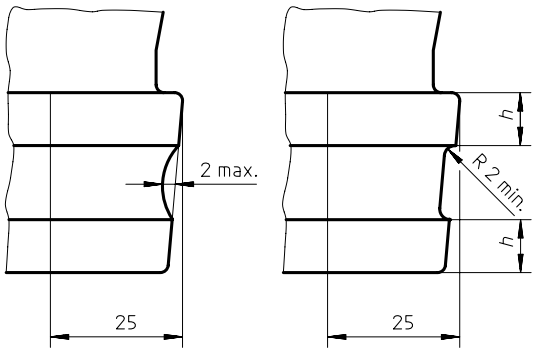
Dimension	Type	
	A	C
l	45±1	40±1
h	9 min.	7 min.

1) Front interface

2) Interface location for the pushing rod test

Figure 5 — Front interface and interface location for the pushing rod test

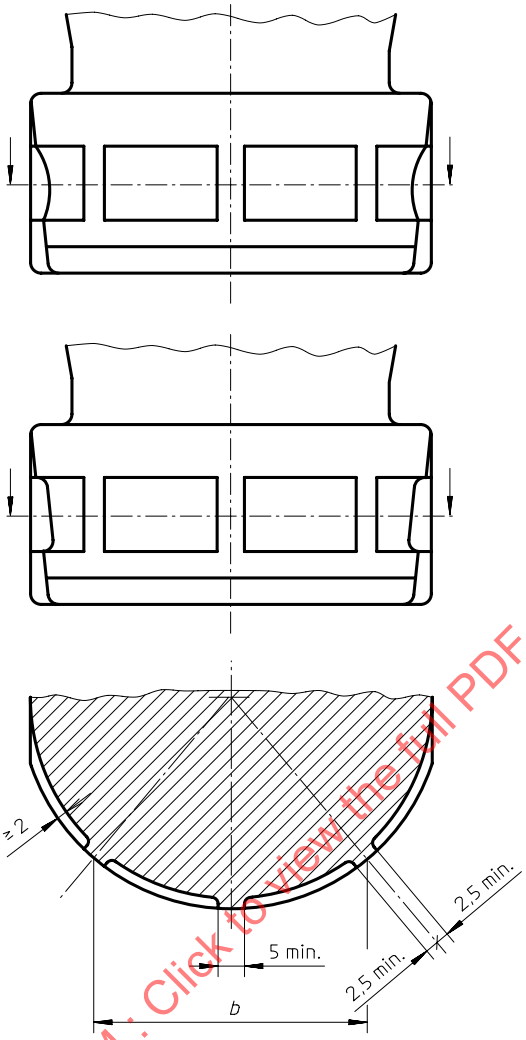
Dimensions in millimetres



h: Type A: 9 min.
Type C: 7 min.

Figure 6 — Lateral grooves at heel

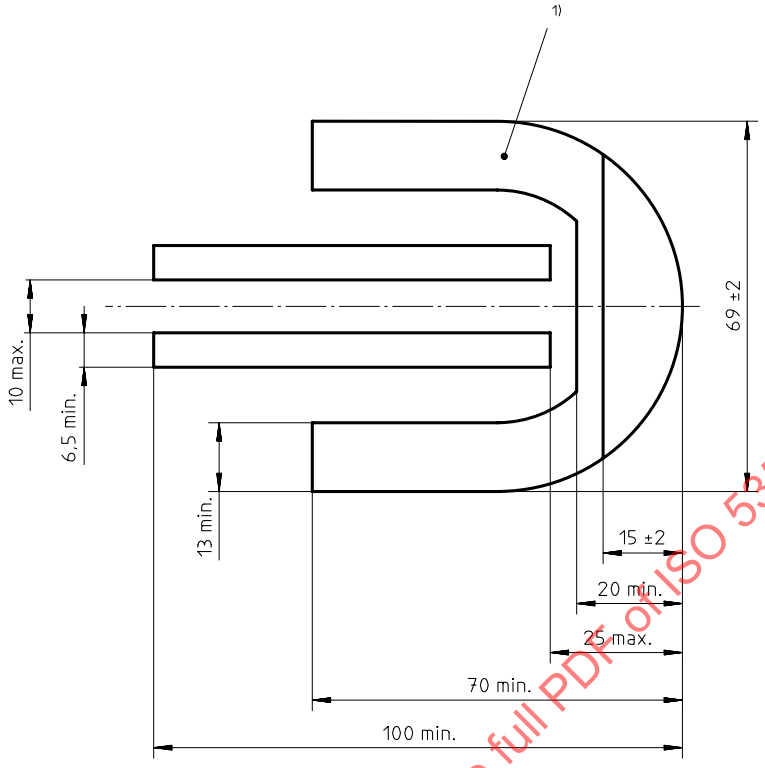
Dimensions in millimetres



b: Type A: 45±1
Type C: 40±1

Figure 7 — Lateral supports at heel

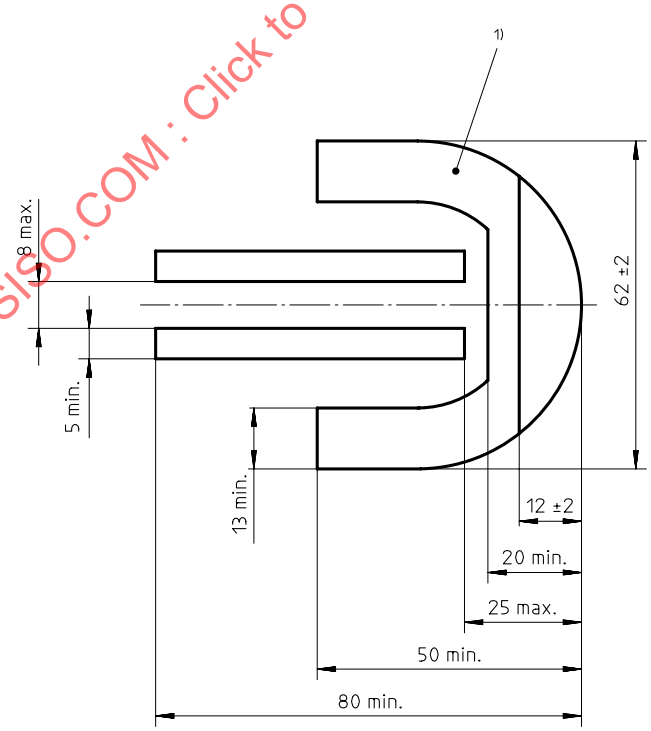
Dimensions in millimetres



1) Peripheral zone

Figure 8 — Example of minimum bearing surface at heel, type A

Dimensions in millimetres



1) Peripheral zone

Figure 9 — Example of minimum bearing surface at heel, type C

Dimensions in millimetres

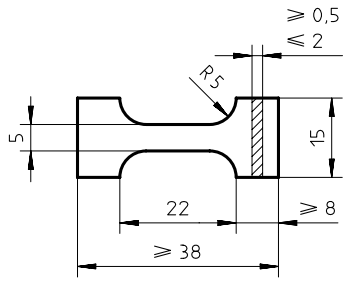
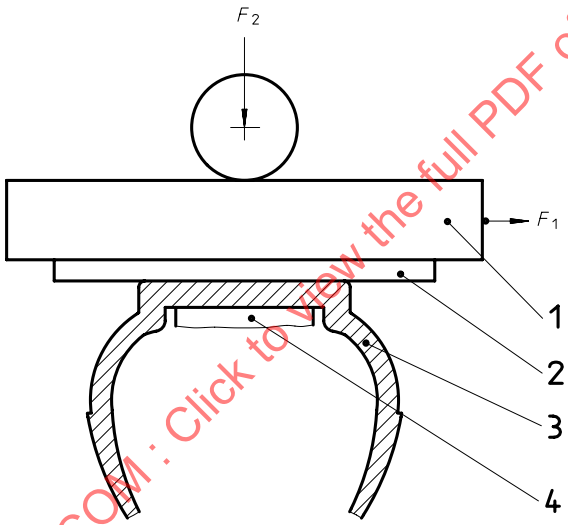


Figure 10 — PTFE specimen



Key

F_1 Vertical test load

F_2 Horizontal test load

1 Low-friction element support

2 Low-friction element [see 5.3.1.1b)]

3 Sample boot

4 Support to prevent boot deformation (see 5.3.1.2)

Figure 11 — Coefficient of dynamic friction test

Annex A

(normative)

Mondopoint system ski-boot sizing and marking

A.1 Reference

This ski-boot sizing system is based on ISO 9407, using only the length of the foot, measured in centimetres.

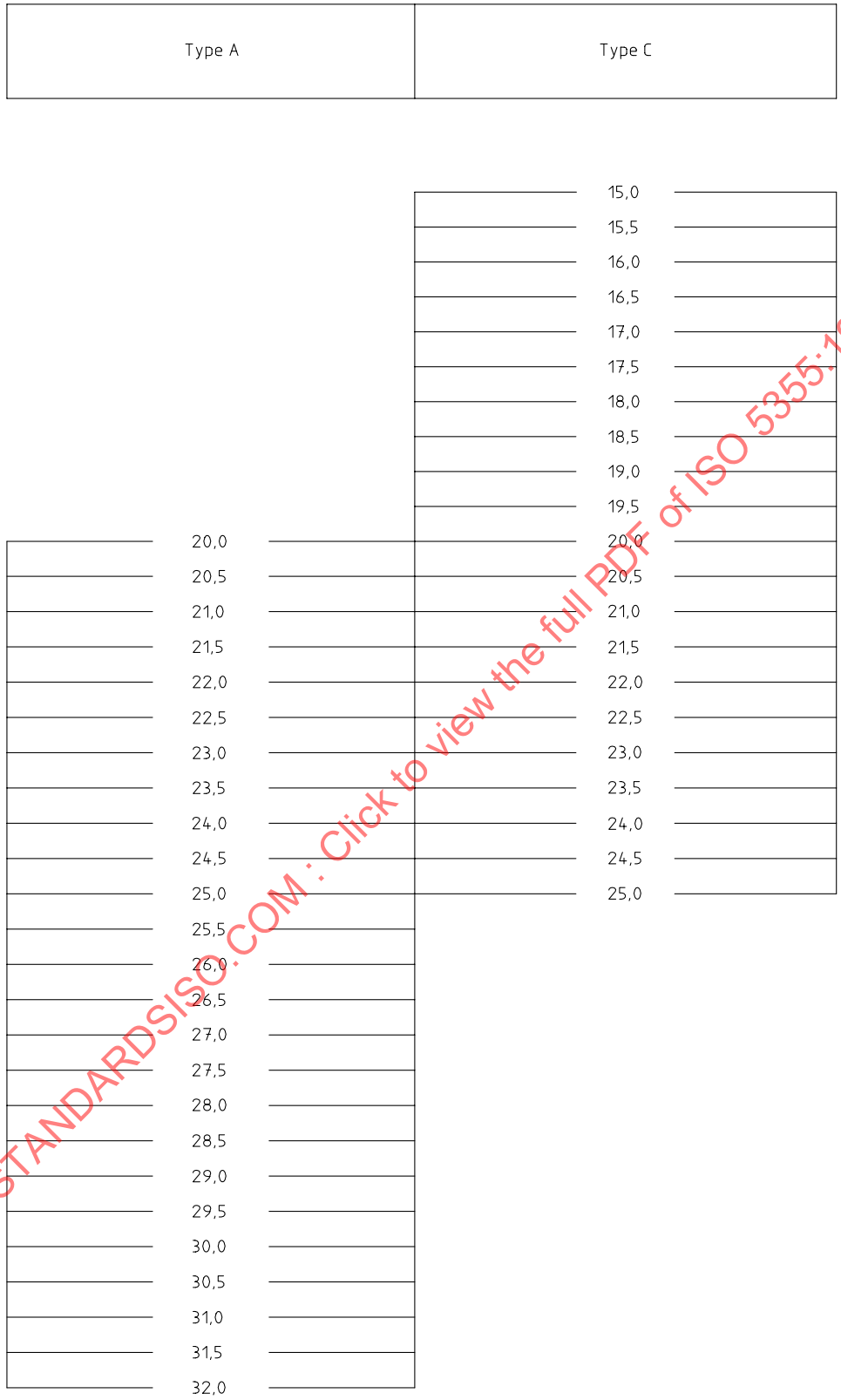
A.2 Range of sizes

The range of sizes shall start with size 15,0 and end (optionally) with size 32,0.

A.3 Length intervals

The length intervals between sizes shall be multiples of 0,5 cm (i.e. the last figure of the size shall be 0 or 5).

Table A.1 — Table of lengths



Annex B

(normative)

Test procedures for the bearing surface at the heel

B.1 Penetration test

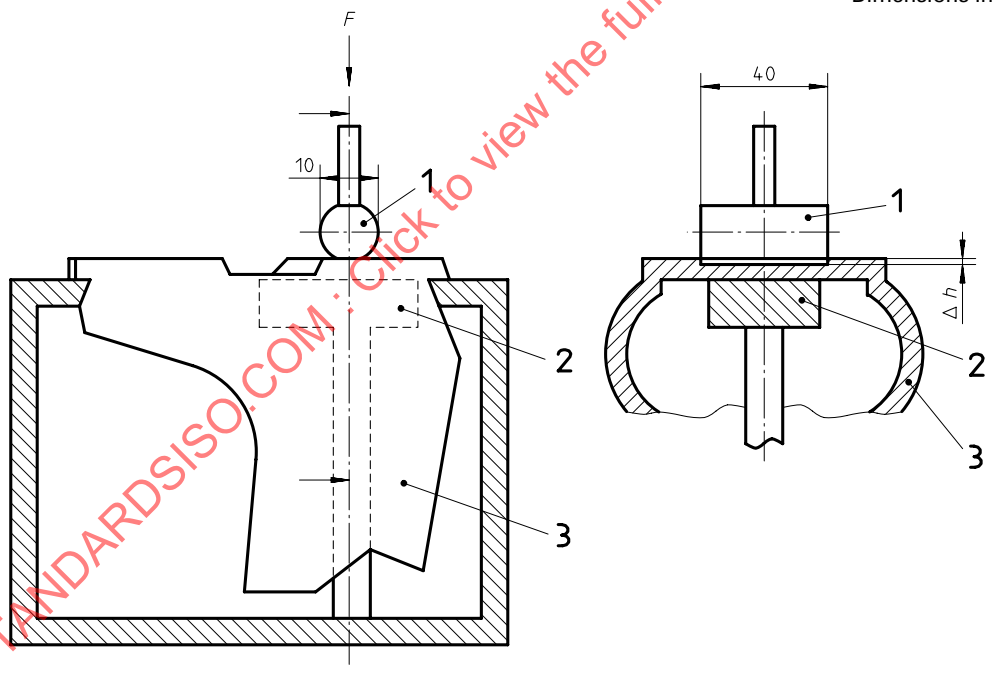
Bring a test cylinder, length 40 mm and diameter 10 mm, onto the heel bearing surface, set the zero with unloaded cylinder and apply load with 500 N perpendicular to the boot, see figure B.1.

After 60 s the cylinder shall not have penetrated into the surface more than 2,5 mm.

B.2 Low-friction test

In an additional test the middle heel bearing zone, type A with 23 mm minimum width and type C with 18 mm minimum width shall fulfil the requirements of 4.2.9. The test is shown in figure B.3.

Dimensions in millimetres

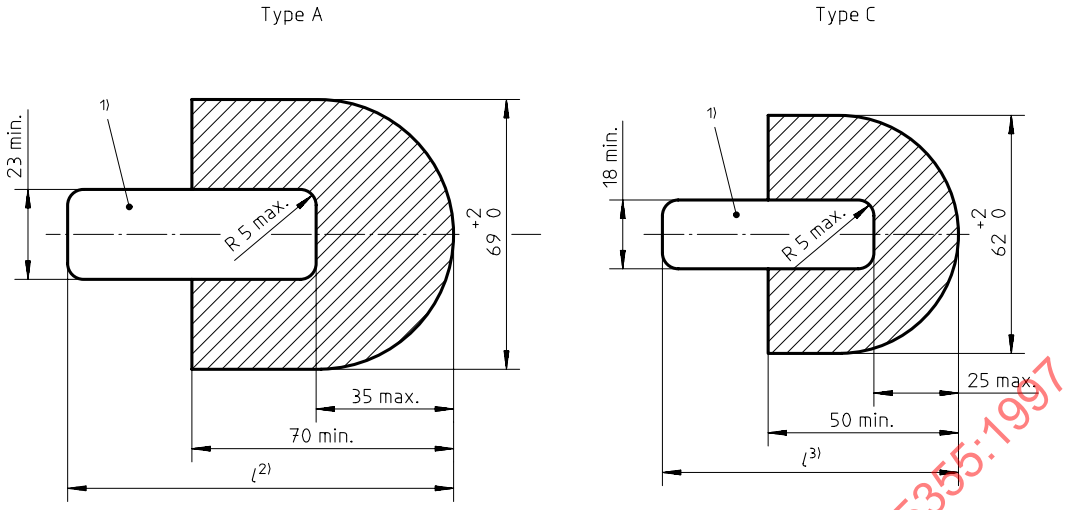


Key

F Test load
1 Test cylinder
2 Support to avoid sole bending (see 5.3.1.2)
3 Sample boot

Figure B.1 — Penetration test

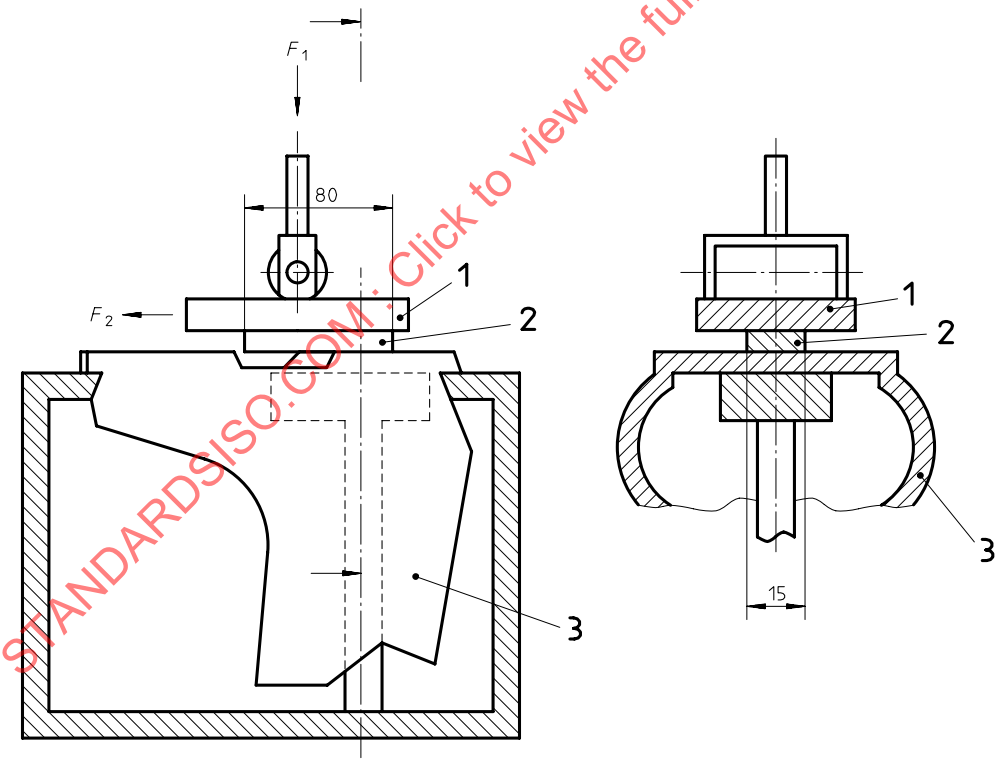
Dimensions in millimetres



1) Non-profiled area may be 0,5 mm maximum deeper than profiled area and shall have the properties of 4.2.9
2) See figure 1
3) See figure 2

Figure B.2 — Bearing surfaces at the heel

Dimensions in millimetres



Key

F_1 Vertical test load

F_2 Horizontal test load

1 Support of low-friction element

2 Low-friction element [same as 5.3.1.1 b), except dimensions 15 mm × 80 mm]

3 Sample boot

Figure B.3 — Low-friction test

Annex C

(normative)

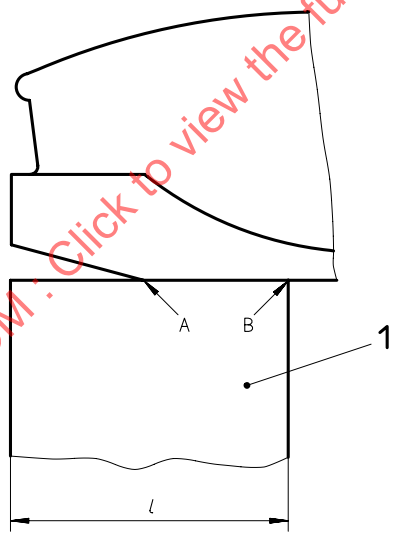
Testing of evenness of bearing surfaces

C.1 When the front bearing surface rests on a plane, a gauge 1 mm thick and 10 mm wide shall not enter the AB area at any point. See figure C.1.

C.2 When the rear bearing surface rests on a plane, a gauge 1 mm thick and 10 mm wide shall not enter the CD area at any point. See figure C.2.

C.3 Before measuring the evenness of the bearing surfaces as described in figure C.3 apply a load of 100 N for type A and 50 N for type C, by inserting into the ski-boot itself a steel cylinder with a diameter of 80 mm (type A) and of 50 mm (type C), the ends rounded with a 10 mm radius and having a corresponding mass. After 5 min, determine the flatness measurement as follows.

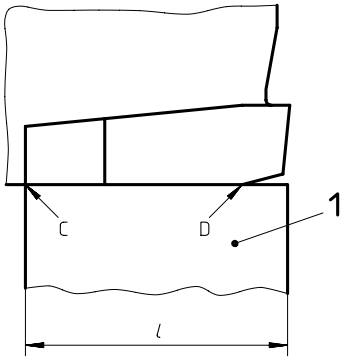
When the boot rests on the test plane (see figure C.3), check the maximum thickness of a 10 mm wide gauge which can enter the BC area anywhere (to a maximum of 2 mm). This gauge shall not enter the AB and CD areas.



Type A: l = 70 mm
Type C: l = 65 mm

Key
1 Test plane

Figure C.1 — Testing of evenness at the front

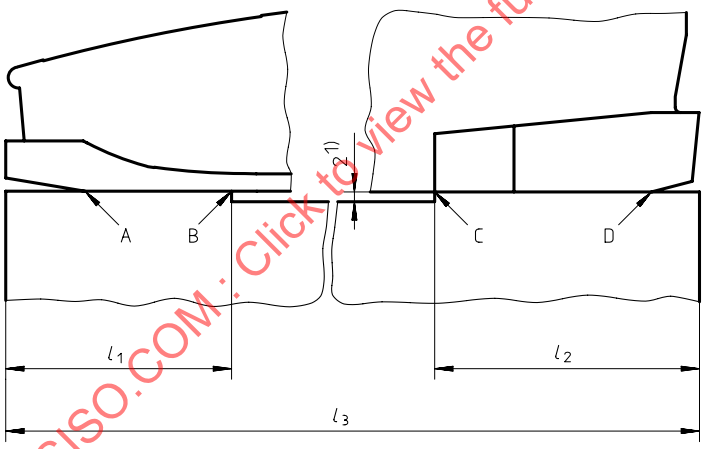


Type A: l = 100 mm
Type C: l = 80 mm

Key
1 Test plane

Figure C.2 — Testing of evenness at the rear

Dimensions in millimetres



Dimension	Type	
	A	C
l_1	70	65
l_2	100	80
l_3	Sole length	

1) Cut-out in the test surface

Figure C.3 — Testing of evenness of the whole boot